HOME BLEACHING PRODUCTS

Background

Home bleaching is a process in which patients apply peroxide-based gels to their discolored teeth for the purpose of lightening (i.e., whitening) them. Although there are many bleaching products, this discussion will cover only those prescribed or dispensed by the dentist and having carbamide peroxide as their active ingredient.

Home bleaching first began in 1968 when an orthodontist in Ft Smith, Arkansas noticed that patients who had been wearing orthodontic positioners filled with the oral antiseptic Gly-Oxide had their teeth whitened. Later, a pedodontist in the same city substituted Proxigel (Reed & Carnrick) for Gly-Oxide in his patients' positioners. He did so because Proxigel (a mixture of 10% carbamide peroxide, water, glycerine, and carbopol) was thicker and, therefore, remained in the positioners longer. Clinical trials of the Proxigel technique in 1988 at the University of North Carolina found it to be effective. An average treatment time of 6 weeks usually produced a lightening of 2 Vita shades. The first commercially available home bleaching product, White and Brite™ (Omnii International), was marketed in March 1989.

Mechanism

Although not fully understood, the mechanism of bleaching appears to involve the decomposition of unstable peroxides into unstable free radicals that break down organic pigmented molecules in discolored enamel through oxidation reactions. The breakdown products are smaller, less heavily pigmented constituents.

Product Ingredients

The main ingredients in most home bleaching products are carbamide peroxide and carbopol.

Carbamide peroxide is also known as urea peroxide, hydrogen peroxide carbamide, and perhydrolurea. It is commonly present in a 10 to 20% concentration; a 10% carbamide peroxide concentration is equivalent in bleaching effectiveness to a 3.6% concentration of hydrogen peroxide. Carbamide peroxide decomposes to hydrogen peroxide and urea. The hydrogen peroxide further decomposes to water and oxygen, while the urea breaks down to ammonia and carbon dioxide.

Carbopol, a high molecular weight polyacrylic acid polymer*,* is usually present in a 0.5 to 1.5% concentration. It functions as a thickening agent and helps to retain the solution in the application tray. This reduces the need for frequent replenishing of the gel. Carbopol has also been found to extend the active oxygen-releasing time of the bleaching solution by up to four times. Carbopol is found in DentlBright (Cura Pharmaceutical), Rembrandt Lighten (Den-Mat), and Opalescence (Ultradent), among many others. Products that do not contain carbopol usually use some other thickening agent. Other ingredients in home

bleaching products include glycerine, sodium stannate, flavorings, and phosphoric or citric acid. Because bleaching solutions are more stable at a lower pH, phosphoric or citric acid is added to lower their pH. Commonly, home bleaching products have a pH range of from 5 to 7, but some products vary from 3 to 8.5 due to variations in quality control. It is important to note that the somewhat low pH of bleaching products is quickly neutralized when the solution comes into contact with saliva.

Product Use

Shelf life is approximately 2 years and is maximized by storing the products in a refrigerator. Most of these materials are applied to the teeth by the patient using a vacuum-formed tray made of plastic. Some manufacturers recommend that reservoirs be built into the tray on the facial surfaces of the involved teeth so that a greater amount of the bleaching gel is retained for a longer period of time. When home bleaching products were first introduced, the daily application times ranged from 1 to 18 hours, with the patient replenishing the solution in the tray every ½ hour to 2 hours. Newer formulations are effective with much shorter application times. Typically, instructions now call for twice daily treatments of from 30 minutes to 2 hours. Many products give the patient the alternative of using overnight applications. Treatment times are often as short as two weeks, and nearly all patients reach their maximum lightening result by the end of six weeks. Patients can expect a lightening of from 1 to 2 Vita shades and results should be noticeable in the first few days of treatment. The retail cost of bleaching products varies greatly, from approximately 20¢ to $2.00 per mL. Bleaching results last for varying lengths of time depending on product used and the specific case, among other things. Most often, relapse occurs two or three years after treatment, however studies have found that the time may vary from 1½ to 7 years.

Examples of Carbamide Peroxide-Containing Home Bleaching Products

Product	*Manufacturer*	*Available Concentrations*
Nupro Gold	Dentsply/Professional	10%, 15%
Opalescence PF	Ultradent	15%, 20%
Rembrandt Lighten	Den-Mat	10%
Zaris	3M ESPE	10%, 16%
VivaStyle	Ivoclar Vivadent	10%, 16%
Perfecta	American Dental Hygienics	11%, 16%, 21%
Platinum	Colgate Oral Pharmaceuticals	10%
Ultimate White and Brite	Omnii International	10%, 16%, 22%

Potential Adverse Effects

Some adverse soft tissue effects have been noted as a result of the use of bleaching products. The most common effect is an ulceration or irritation of the gingiva and mucosa. It is usually mild and transient and can easily be resolved by reducing the daily application period.[1] Sore throats that have occurred with the use of bleaching agents have apparently been related to the use of cinnamon flavoring in some products to which a small portion of the population is allergic.

Bleaching agents may also affect dental hard tissues. The most common side effect is a transient and dose-related sensitivity of the teeth to thermal changes. This is believed to result from the freely diffusible nature of the solution[2] rather than its low pH. Clinical observations indicate that home bleaching with 10% carbamide peroxide solutions does not adversely affect pulpal tissues.[3] Temperature sensitivity during treatment can be reduced/eliminated by treating the involved teeth with a desensitizer (e.g., D/Sense 2 [Centrix], Seal & Protect [Dentsply/Caulk], Systemp.desensitizer [Ivoclar Vivadent]) or a dentin bonding agent (e.g., Single Bond [3M ESPE], One-Up Bond F [J. Morita], Excite [Ivoclar Vivadent]).

Several studies have been done to evaluate how home bleaching agents affect enamel and dentin. One study found that bleaching agents were capable of removing the smear layer from dentin, but produced relatively few changes in the enamel.[4] Studies evaluating whether or not enamel is adversely affected by home bleaching agents have produced equivocal results. While several have found no evidence of adverse effects,[2,5] others have shown that changes occur in the porosity and surface morphology of enamel.[6-8]

Home bleaching products can affect the bond strength of resin composite to etched enamel. One investigation found that bond strength was significantly reduced by a single, 24-hour bleaching treatment using a popular home bleaching product.[9] Another study found that bleaching with 10 to 20% carbamide peroxide gels significantly decreased bond strength for up to 2 weeks after the bleaching treatment was completed.[10] An initial reduction in bond strength following the use of at least some products does occur and is believed to be due to the presence of oxygen in the tooth surface, which inhibits resin polymerization. It is prudent to wait several weeks after completion of bleaching treatment before bonding to the involved teeth.

An additional problem that has been associated with home bleaching is temporomandibular dysfunction (TMD) which can occur as a result of changes in the occlusion secondary to long-term tray use. This is now less of a problem than it was originally when trays were worn for many hours each day. The problem can also be minimized by using a thin (i.e., ½-mm-thick) tray material. Thin trays not only help reduce the possibility of TMD problems, but are also more esthetically pleasing to patients. Trays should be trimmed carefully, because impingement on soft tissues can cause irritation.

Effects on Dental Materials

Studies evaluating the effects of home bleaching products on restorative materials have produced equivocal results. One study found that a home bleaching gel significantly reduced the hardness of a hybrid resin composite over a four-week treatment period. Scanning electron photomicrographs also revealed surface cracking.[11] Bleaches have been found to adversely affect the color of various restorative materials, with glass ionomers exhibiting the greatest color change.[12] Another investigation found that the shades of two hybrid and one microfill composite were unaffected by two home bleaching products.[13] Still another report found no adverse effects from bleaching solutions on either the surface texture or color of porcelain, resin composite, amalgam, or gold restorations.[4] Some researchers believe that the tendency for bleaching agents to adversely affect restorative materials is related to their pH because greater effects have been noted for products with pH values below 5.5.

Safety

As home bleaching products grew in popularity, the American Dental Association's Council on Scientific Affairs began to monitor their development. Its conclusion, based on the clinical data obtained over the last ten years, was that 10% carbamide peroxide products with neutral pH are safe and effective. The following 10% carbamide peroxide products have, in fact, received the ADA Seal of Acceptance: Opalescence, Colgate Platinum, Rembrandt Lighten, Patterson Brand Tooth Whitening Gel (Patterson Dental), and Nite White Classic (Discus Dental).

It is important to be aware of several things, however. Because peroxides are mutagens, some researchers and clinicians recommend that bleaching products not be used in patients who are smokers or heavy drinkers, since the carcinogenic effects may be additive. Peroxides can also delay wound healing when used for long periods. In addition to the complications of bleaching already noted (i.e, soft tissue irritation, TMD, sore throat, tooth sensitivity), nausea has also been reported.

<u>References</u>

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